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undercut portion forming a shoulder and an acute, wedge-shaped edge with the periphery of said adhesion surface, said wedge-shaped edge oriented to face away from said adhesion surface and to oppose said shoulder.—

REMARKS

Claims 1-10 are pending in the application. By this Amendment, claim 1 is amended, and new claims 2-10 are added. Prompt and favorable consideration is requested. Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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Version with Markings to Show changes Made

On page 1, delete paragraph one, lines 1-3 as follows:

[Body to be Bonded to a Machine Housing and Adhesive Connection Between an Adhesion Surface of a Body and a Corresponding Adhesion Surface on the Outside of a Machine Housing].

On page 1, before paragraph two, insert new paragraphs as follows:

Cross-Reference To Related Applications

This application is a divisional of United States Patent Application Serial No. 09/262,559, filed on March 3, 1999, now abandoned; which is a divisional application of United States Patent Application Serial No. 08/894,107 filed August 12, 1997 now abandoned, which is the United States National Stage of PCT International Application No. PCT/EP95/04939, filed on December 13, 1995, and claims priority from the PCT application under 35 U.S.C. §119.

BACKGROUND OF THE INVENTION

Field of the Invention

On page 2, substitute paragraph 5, starting at line 16-19 as follows:

The aforementioned problem will be solved for one part by providing a design of the metallic body to be bonded in accordance with [claim 1] an embodiment of the present invention and for another part by the specific creation or design of the adhesive connection between such body and the housing of a machine in accordance with [claim 9] an embodiment of the present invention.

On page 2, substitute paragraph 6, starting at line 20 through page 3, line 3 as follows:

The characteristics of [claim 1] an embodiment of the invention will assure, that an adhesive (or glue) which is supplied in a sufficient amount between metallic body and the housing of a machine will not only be distributed reliably about the adhesion surface while the metallic body and the housing of the machine will be made to rotatably approach each other. Moreover, the adhesive will also be drawn into the region of an undercut direct adjacent to the adhesion surface, in a claw-giving fashion, onto the dorsal (back) side of the wedge shaped form (of the undercut). This will produce an especially strong connection between a housing of a machine and the metallic body once the adhesive has cured. A prerequisite for this kind of connection is, that the amount of adhesive that is supplied to a body designed according to [claim 1] an embodiment of the invention and a housing of a machine, will be more than an amount that would be sufficient only to cover the adhesion surfaces. Also, the metallic body will have to approach the housing of a machine in a rotating way about an axis of rotation that is perpendicular to the adhesion surface, preferably about ca. the central longitudinal axis of the metallic body.

On page 3, before paragraph 9, insert as follows:

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

1. (Amended) A metallic body, to be bonded to the outside of a housing of a machine, especially a vibrating machine, [in particular the] said metallic body comprising [constituting] a housing or shell of a sensor, [which] said sensor [is] capable of converting a physical quantity, in particular a physical quantity related to one or more aspects of mechanical vibration, into a corresponding electrical signal, or said [the] metallic body comprising [in particular constituting] an adaptor for attaching said sensor to the housing of the [a] machine, said [the] body further comprising [exhibiting] a substantially flat adhesion surface, characterized in that said [, that the] adhesion surface is adapted to accept a layer of adhesive thereon and is provided with [adjoined or supplemented, towards a central volume part of the body, by] an undercut portion which forms a shoulder and an [a] acute, wedge-shaped edge with the periphery of said [the] adhesion surface, said wedge-shaped edge oriented to face away from said adhesion surface and to oppose said shoulder.

Title:

Body to be Bonded to a Machine Housing and Adhesive Connection Between an Adhesion Surface of a Body and a Corresponding Adhesion Surface on the Outside of a Machine Housing

5 Description of the Invention Background

The invention relates to a metallic body to be bonded to the outside of a housing, i.e. shell or encasing, especially a vibrating machine. In addition, the invention especially relates to the housing of a sensor intended for transforming a physical quantity, in particular vibration, into a corresponding electrical signal, or
10 relates to an adaptor for attaching such a sensor to the housing of a machine, the body exhibiting a substantially flat adhesion surface, and the invention relates to an adhesive connection between the adhesive surface of such a body and a corresponding opposite adhesive surface situated on the outside of a machine housing.

Sensors for transforming a physical quantity into a corresponding
15 electrical signal, for example, acceleration sensors for transforming signals of vibration into a corresponding electrical signal, frequently have to be fastened to the housing of a machine in a durable and reliable manner, as well as in a suitable manner that allows an undistorted and essentially undamped transmission of the physical quantity to be transformed. This should be done either by direct action or, in the case
20 the sensor is intended for easy dismounting, by means of an adaptor which has to be fastened to the housing of a machine in a corresponding manner.

A known method of attaching will provide a sensor or adaptor to be screwed onto the housing of a machine, such housing being provided with a threaded hole of comparatively extensive diameter, and a solid threaded stub that extends from
25 the housing of the sensor or of an adaptor, will be screed into said threaded hole. This known method of fastening requires considerable amounts of work and is time-consuming, especially in the case the threaded hole will have to be provided to the machine after the machine has been placed to its intended working position, which is the most frequent case.

In addition, the aforementioned known method of attaching a sensor or and adaptor to a housing of a machine will not be applicable in case the housing must not be drilled into.

5 In order to avoid the aforementioned difficulties it has been suggested already, to bond the sensor or the adaptor to the housing of a machine by gluing.

Especially with vibrating machinery the problem had not yet been solved, to attain an adhesive connection between a sensor or an adaptor and the housing of a machine which will be long-lasting and which will have strength of such quality to assure a reliable bonding.

10 The underlying problem, and therefore an object of the invention, is to design both the body to be bonded and the adhesive connection in such manner, that a permanent attachment of the sensor will be effected solely by gluing, i.e. without the necessity of drilling a screw hole (tap hole) of large dimension into the housing of a machine.

15 Summary of the Invention

The aforementioned problem will be solved for one part by providing a design of the metallic body to be bonded in accordance with claim 1 and for another part by the specific creation or design of the adhesive connection between such body and the housing of a machine in accordance with claim 9.

20 The characteristics of claim 1 will assure, that an adhesive (or glue) which is supplied in a sufficient amount between metallic body and the housing of a machine will not only be distributed reliably about the adhesion surface while the metallic body and the housing of the machine will be made to rotatably approach each other. Moreover, the adhesive will also be drawn into the region of an undercut direct
25 adjacent to the adhesion surface, in a claw-giving fashion, onto the dorsal (back) side of the wedge shaped form (of the undercut). This will produce an especially strong connection between a housing of a machine and the metallic body once the adhesive has cured. A prerequisite for this kind of connection is, that the amount of adhesive that is supplied to a body designed according to claim 1 and a housing of a machine,
30 will be more than an amount that would be sufficient only to cover the adhesion

surfaces. Also, the metallic body will have to approach the housing of a machine in a rotating way about an axis of rotation that is perpendicular to the adhesion surface, preferably about ca. the central longitudinal axis of the metallic body.

5 The invention may not only be used with advantage when bonding sensors or adaptors for sensors to a housing of a machine, but also is of advantage for attachment of any metallic body to machines by bonding or gluing, in particular for attaching to those machines that may vibrate and which require a permanent connection of high strength of stability.

Brief Description of the Drawings

10 Subsequently, the invention will be explained in more detail, referring to the drawing of a preferred embodiment.

In the accompanying drawing, it is shown by

Fig. 1: a side view, partly as a longitudinal section, of a metallic body relating to the form of a sensor or an adaptor for a sensor, the body being attached to
15 the housing of a machine

Fig. 2: a cross section along cutting line II-II of Fig. 1 through the adhesive connection between the metallic body and the housing of a machine

Fig. 3: a plan view of the adhesion surface on the housing of a machine, intended for bonding the metallic body onto it, and

20 Fig. 4: a cross section (to enlarged scale) of a thread grooving stud that is additionally provided for an adhesive connection according to Fig. 1.

In Fig. 1 a metallic body 1 is shown from a side view, being adhesively bonded to a housing 2 of a machine. The housing 2 of a machine is shown in longitudinal section along a sectional plane which includes a centerline 3, which
25 centerline defines a rotational symmetry of body 1. Also, adhesive 5 is shown in a cutaway view along said sectional plane.

In the drawing of Fig. 1 only a part of the housing 2 of a machine is shown, being of proximity to body 1. The machine may constitute for example a

motor, or a generator, or the like, the vibrations of such machine being measured e.g. in order to monitor the wear of a rolling-bearing provided for its rotor. For this purpose, an acceleration sensor is set onto (lit: in) and contacting the metallic body 1, or else, body 1 constitute an adapter for receiving a separate sensor intended for acceleration measurements, such that the sensor may be fastened to the adaptor, but
5 allowing for easy disengagement of same.

Metallic body 1, on its face side that is oriented towards the housing 2 of a machine, exhibits a disk-like shoulder 4, body and shoulder being unitary and made from the same piece of material. Also, the face area of body 1 oriented towards
10 the housing 2 of a machine is constituting an adhesion surface 4a for adhesively bonding body 1 to an opposite adhesive surface 2a of a housing 2 of a machine.

The disk-like shoulder 4 is formed in such way, that the adhesion surface 4a is adjoined or supplemented, towards the central volume of body 1, by an undercut 4b which forms an acute, wedge-shaped edge with the periphery of the
15 adhesion surface 4a. Thus, the mentioned shoulder will be formed like a truncated cone turned upside down. Using a design of this kind will effect a sufficient amount of adhesive 5 that is applied to adhesive surface 2a and which amount is greater compared to an amount required for only covering adhesion surfaces 2a and 4a, to be drawn into the undercut 4b in a reliable manner. After curing, the adhesive will set
20 behind the undercut in a claw-like fashion around the periphery of the disk-like shoulder 4. By this an especial strong and vibration-resistant permanent connection between metallic body 1 and housing 2 of a machine will be obtained, as soon as the adhesive has hardened.

In order to even improve the bonding strength of adhesive 5 against
25 adhesion surface 4a of body 1, this surface will be pre-formed with multiple grooves 6, as shown in Fig. 2, and the single grooves 6a having an arc-like curvature, e.g. the demonstrated embodiment shows arcs of circles that intersect each other.

In order to improve the bonding strength of the adhesive 5 against an opposite adhesion surface 2a of the housing of a machine, this surface is also provided
30 with a set of multiple grooves 7, the single grooves 7a of which intersect according to a pattern of checkers (karoartig). The embodiment, presented as an example, shows

these grooves to be straight. However, they may exhibit an arc-like curvature comparable to grooves 6a of adhesion surface 4a.

It is preferred, to have opposite adhesive surface 2a of housing 2 of a machine, as well as adhesive surface 4a of body 1, of essentially flat shape.

5 Usually, it will take some time before the adhesive has hardened, which has been applied to adhesion surfaces 2a and 4a and which adhesive, after said adhesion surfaces have been placed closely to each other, has progressed into undercut 4b. Therefore, it is advised to stabilize the position of body 1 relative to housing 2 by additional means. For this purpose, it is intended to utilize a stud 8
10 which is provided with a thread for cutting or generating threadlike grooves, the cross section of said stud being of polygon shape (cf. Fig. 4). Stud 8 may be screwed into a central bore-hole within adhesion surface 4a or also into a central bore-hole of adhesion surface 2a of a housing 2 of a machine, with the thread of the stud being worked into the walls of said bore-holes, and the bore-holes being oriented
15 perpendicular to the mentioned adhesion surfaces.

 The primary function of this thread grooving stud 8 is not intended to fasten body 1 onto a housing 2 of a machine, but rather to secure body 1 to its predefined final position, whilst the adhesive has not hardened. Of course, this stud will improve the strength of the connection to a certain degree once the adhesive has
20 hardened, however, the adhesive connection is of such design, that it will exhibit sufficient permanent strength of the bonding after the adhesive has hardened, even without this thread-grooving stud 8.

 Figures 2 and 3 do not show the thread-grooving stud 8. In case it is allowed to drill into the housing 2 of a machine so as to furnish a corresponding bore-
25 hole 2b, this stud will be screwed into bore-hole 4c of body 1 as well as into bore-hole 2b of housing 2. However, an intended adhesive connection from body 1 to housing 2 of a machine may be rendered as well, in case it is not allowed to make a bore-hole 2b into a corresponding housing 2 of a machine.

 According to the invention, it is preferred to use a metal based glue 5
30 consisting of a plastic base-material and a metallic filler (e.g. so called plastic-steel). This not only will yield the intended mechanical connection of very high strength

between body 1 and the housing 2 of a machine, but also will produce a most possible undamped and undistorted transfer of a physical quantity to be studied, which is vibration in the embodiment discussed as a preferred example, in direction towards the sensor. The reason for this is, that an adhesive of this type has also very good

5 properties regarding that aspect, because of its incorporated metal filler.

Patent Claims/What is Claimed

1. A metallic body (1), to be bonded to the outside of a housing (2) of a machine, especially a vibrating machine, in particular the metallic body (1) constituting a housing or shell of a sensor, which sensor is capable of
- 5 converting a physical quantity, in particular a physical quantity related to one or more aspects of mechanical vibration, into a corresponding electrical signal, or the metallic body (1) in particular constituting an adaptor for attaching said sensor to the housing of a machine, the body (1) exhibiting a substantially flat adhesion surface (4a),
- 10 characterized in that, that the adhesion surface (4a) is adjoined or supplemented, towards a central volume part of the body, by an undercut (4b) which forms an acute, wedge-shaped edge with the periphery of the adhesion surface (4a).

Abstract of the Disclosure

- 5 A body to be bonded to a machine housing. The body may include a substantially flat adhesion surface provided with an undercut portion. The undercut portion may form a disc-like shoulder and an acute, wedge-shaped edge with the periphery of the adhesion surface, wherein the wedge-shaped edge is oriented to face away from the adhesion surface and to oppose the shoulder. The machine housing may further be provided with grooves adapted to improve the strength of a bond between an adhesive material and the adhesion surface.